in a matrix and rearranged by at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.

REMARKS

A final Office Action was mailed on May 8, 2002. Claims 1 – 53 are pending in the present application. Claims 1 – 5, 7, 8, 10 – 12, 14, 15, 17 – 26, 31 – 38 and 43 – 53 are amended No new matter is introduced.

OBJECTION TO DRAWING

Figures 22 – 24 are objected to as failing to be designated as "Prior Art". Applicants include proposed red-line changes to these figures, and will proceed to submit formal revisions to the drawing upon approval of the proposed red-line changes and allowance of the present application. No new matter is introduced. With approval of these changes, Applicants respectfully request that the Examiner withdraw the objection to the drawing.

OBJECTION TO SPECIFICATION

The specification is objected to at page 6, lines 9 – 12 for referencing a feature in Fig. 14 that is not shown in Fig. 14. Applicants amend the specification at page 6, lines 9 – 12 to reference Fig. 24 in place of Fig. 14, and respectfully request that the Examiner withdraw the objection to the specification.

OBJECTED CLAIMS

Claims 31 – 42, 46 and intervening claims are objected for reciting a "second" storage unit that suggest the existence of a first storage unit. Applicants eliminate this

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recitation, and respectfully request that the Examiner withdraw the objection to these claims.

REJECTIONS UNDER 35 U.S.C. § 112

Claims 43, 49 and intervening claims are rejected under the second paragraph of 35 U.S.C. § 112 for lacking sufficient antecedent basis for the term "the error correcting code". Applicants amend these claims to provide proper antecedent basis, and respectfully request that the Examiner withdraw this rejection.

REJECTIONS UNDER 35 U.S.C. §§ 102, 103

Claim 1 - 53 are rejected under 35 U.S.C. § 103(a) as unpatentable over a variety of combinations of references:

- Applicants' admitted prior art (AAPA) in view of U.S. Patent No. 5,068,878 to Lin et al. and de Almeida et al. ("Two-Dimensional Interleaving Using The Set Partitioning Technique")

- AAPA in view of U.S. Patent No. 4,959,863 to Azuma et al. and de Almeida

- AAPA in view of Yamaguchi et al. ("'Turbo Code', a new coding system approaching theoretical Shannon limits, is born in France") and de Almeida

- AAPA in view of U.S. Patent No. 5,204,981 to Karasawa et al. and de Almeida

- Karasawa in view of Yamaguchi and de Almeida

- Karasawa in view of Azuma and de Almeida

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Applicants amend independent claims 1 – 3, 10, 17 – 20, 23, 24, 31, 32, 35, 36, 43, 44, 46 and 49 to recite an interleaving and de-interleaving method and apparatus involving the steps of arranging data to be transmitted in a matrix, and either randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data or randomly interchanging at least one of rows of the matrix, each row representing a set of data pieces of said data, and columns of the matrix, each column representing a set of data pieces of said data.

Applicants respectfully submit that none of the cited references, either alone or in combination, disclose or otherwise suggest Applicants' claimed method and apparatus. Based on the interchange of entire rows and/or columns of the matrix, Applicants' approach is substantially simplified, for example, over the interleaving and de-interleaving method disclosed by de Almeida, while still preventing a biased distribution of data relative to burst errors.

Accordingly, Applicants respectfully suggest that independent claims 1 – 3, 10, 17 – 20, 23, 24, 31, 32, 35, 36, 43, 44, 46 and 49, and the claims that depend from these independent claims, are not made obvious by the cited references, and therefore stand in condition for allowance.
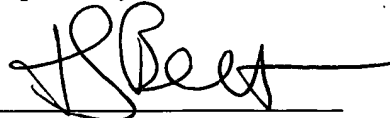
CONCLUSION

An earnest effort has been made to be fully responsive to the Examiner's objections. In view of the above amendments and remarks, it is believed that independent claims 1 – 3, 10, 17 – 20, 23, 24, 31, 32, 35, 36, 43, 44, 46 and 49, and the claims that depend therefrom, stand in condition for allowance. Passage of this case to allowance is earnestly solicited. However, if for any reason the Examiner should

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consider this application not to be in condition for allowance, he is respectfully requested

to telephone the undersigned attorney at the number listed below prior to issuing a further

Action.

Attached is a marked up version of the changes made to the claims by the current

amendment. The attached pages are captioned **"Version With Markings To Show**

Changes Made".

Any fees due with this paper may be charged on Deposit Account 50-1290.

Respectfully submitted,

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Reg. No. 44,528

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IN THE SPECIFICATION

Please change the paragraph beginning at page 6, line 9 with the following:

Next, [assuming] <u>assume</u> that burst errors [generate] <u>are generated</u> in the data (198, 099, 305, 152, 332, 166, 083, 041, 276, 197, 354, 177, 088, 300, 150 and 331) in the 14th row shown in FIG. [14] <u>24</u>.

IN THE CLAIMS

1. (Twice Amended) An interleaving method comprising the steps of:

arranging data to be transmitted in a matrix; and

[randomly] rearranging said data by [exchanging data units between rows and between columns,] <u>randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data;</u> and

outputting said rearranged data in time series.

2. (Twice Amended) A de-interleaving method comprising the steps of:

arranging received data having been interleaved in a matrix; and

[randomly] rearranging said data by [exchanging data units between rows and between columns,] <u>randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data;</u> and

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outputting said data in time series, thereby outputting said received data in the order before said received data was interleaved.

3. (Twice Amended) An interleaving apparatus for interleaving data to be transmitted, comprising:

a [first] storing unit for storing data to be transmitted; and

a [first] control unit for controlling said [first] storing unit so that said data to be transmitted is outputted from said [first] storing unit with said data to be transmitted arranged in a matrix and said data to be transmitted [randomly] rearranged by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data.

4. (Twice Amended) The interleaving apparatus according to claim 3, wherein said [first] control unit comprises a [first] write control unit for generating a write address to be used to write said data to be transmitted in said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, and for writing said data to be transmitted in said [first] storing unit, and said [first] control unit reads said data to be transmitted stored in said [first] storing unit in the order of

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addresses.

5. (Amended) The interleaving apparatus according to claim 4, wherein said [first] write control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [first] write control unit writes said data to be transmitted in said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said write address to write said data to be transmitted in said [first] storing unit.

6. (Unchanged) The interleaving apparatus according to claim 5, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

7. (Twice Amended) The interleaving apparatus according to claim 3, wherein said [first] control unit writes said data to be transmitted in said [first] storing unit in the order of addresses, and said [first] control unit comprises a [first] read control unit for generating a read address to be used to read said data to be transmitted from said [first] storing unit with said data to be transmitted stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units between rows and between columns] <u>randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data</u> to read said data to be transmitted.

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8. (Amended) The interleaving apparatus according to claim 7, wherein said [first] read control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [first] read control unit reads said data to be transmitted from said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said read address.

9. (Unchanged) The interleaving apparatus according to claim 8, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

10. (Twice Amended) A de-interleaving apparatus for de-interleaving received data, comprising:

a [second] storing unit for storing said received data; and

a [second] control unit for controlling said [second] storing unit so that said received data is outputted from said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data.

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11. (Twice Amended) The de-interleaving apparatus according to claim 10, wherein said [second] control unit comprises a [second] write control unit for generating a write address to be used to write said received data in said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to write said received data, and said [second] control unit reads said received data stored in said [second] storing unit in the order of addresses.

12 (Amended) The de-interleaving apparatus according to claim 11, wherein said [second] write control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [second] write control unit writes said data in said [second] storing unit with numbers generated by said column number generating unit and said row number generating unit as a write address.

13. (Unchanged) The de-interleaving apparatus according to claim 12, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

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14. (Twice Amended) The de-interleaving apparatus according to claim 10, wherein said [second] control unit writes said received data in said [second] storing unit in the order of addresses, and said [second] control unit has a [second] read control unit for generating a read address to be used to read said received data in a state before said received data was interleaved from said [second] storing unit by arranging said received data stored in said [second] storing unit in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] <u>randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data,</u> and for reading said received data from said [second] storing unit.

15. (Amended) The de-interleaving apparatus according to claim 14, wherein said [second] read control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [second] read control unit reads said received data from said [second] storing unit with numbers generated by said column number generating unit and said row number generating unit as a read address.

16. (Unchanged) The de-interleaving apparatus according to claim 15, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

17. (Twice Amended) An interleaving/de-interleaving system comprising an interleaving apparatus for interleaving data to be transmitted and a de-interleaving apparatus for receiving said transmitted data interleaved by said interleaving apparatus to de-interleave said transmitted data, wherein said interleaving apparatus outputs said data to be transmitted with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, and said de-interleaving apparatus outputs received data in a state before said transmitted data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data.

18. (Twice Amended) An interleaving/de-interleaving apparatus for transmitting/receiving interleaved data to/from an opposite interleaving/de-interleaving apparatus, comprising:

an interleaving apparatus for outputting data to be transmitted to said opposite interleaving/de-interleaving apparatus with said data to be transmitted arranged in a matrix, and said data to be transmitted [randomly] rearranged by [exchanging data units between rows and between columns] randomly interchanging

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rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

a de-interleaving apparatus for outputting received data interleaved in said opposite interleaving/de-interleaving apparatus in a state before said received data was interleaved by arranging said received data in a matrix, and [randomly] rearranging said received data by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data.

19. (Amended) An interleaving apparatus for interleaving data to be transmitted, comprising:

a [first] storing unit for storing data to be transmitted;

a [first] control unit for controlling said [first] storing unit so that said data to be transmitted is outputted from said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

wherein said [first] control unit comprises a [first] write control unit for generating a write address to be used to write said data to be transmitted in said [first]

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storing unit with said data to be transmitted arranged in a matrix and [randomly]

rearranged by [exchanging data units at least between rows or between columns] at least

one of randomly interchanging rows of the matrix, each row representing a set of data

pieces of said data, and randomly interchanging columns of the matrix, each column

representing a set of data pieces of said data, and for writing said data to be transmitted in

said [first] storing unit, and said [first] control unit reads said data to be transmitted stored

in said [first] storing unit according to the order of addresses of said [first] storing unit.

20. (Amended) An interleaving apparatus for interleaving data to be

transmitted, comprising:

a [first] storing unit for storing data to be transmitted;

a [first] control unit for controlling said [first] storing unit so that said data to

be transmitted is outputted from said [first] storing unit with said data to be transmitted

arranged in a matrix and [randomly] rearranged by [exchanging data units at least

between rows or between columns] at least one of randomly interchanging rows of the

matrix, each row representing a set of data pieces of said data, and randomly

interchanging columns of the matrix, each column representing a set of data pieces of

said data; and

wherein said [first] control unit comprises a [first] write control unit for

generating a write address to be used to write said data to be transmitted in said [first]

storing unit with said data to be transmitted arranged in a matrix and [randomly]

rearranged by [exchanging data units at least between rows or between columns] at least

one of randomly interchanging rows of the matrix, each row representing a set of data

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pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, and for writing said data to be transmitted in said [first] storing unit so as to be read said data from said [first] storing unit according to the order of addresses of said [first] storing unit.

21. (Amended) The interleaving apparatus according to claim 19, wherein said [first] read control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [first] write control unit writes said data to be transmitted in said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said write address to write said data to be transmitted in said [first] storing unit.

22. (Amended) The interleaving apparatus according to claim 20, wherein said [first] write control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [first] write control unit writes said data to be transmitted in said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said write address to write said data to be transmitted in said [first] storing unit.

23. (Amended) An interleaving apparatus for interleaving data to be transmitted, comprising:

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a [first] storing unit for storing data to be transmitted;

a [first] control unit for controlling said [first] storing unit so that said data to be transmitted is outputted from said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

wherein said [first] control unit writes said data to be transmitted in said [first] storing unit according to the order of addresses of said [first] storing unit, and said [first] control unit comprises a [first] read control unit for generating a read address to be used to read said data to be transmitted from said [first] storing unit with said data to be transmitted stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.

24. (Amended) An interleaving apparatus for interleaving data to be transmitted, comprising:

a [first] storing unit for storing data to be transmitted;

a [first] control unit for controlling said [first] storing unit so that said data to be transmitted is outputted from said [first] storing unit with said data to be transmitted

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arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

wherein said [first] control unit comprises a [first] read control unit for generating a read address to be used to read said data to be transmitted, written in the order of addresses of said [first] storing unit, from said [first] storing unit with said data to be transmitted stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.

25. (Amended) The interleaving apparatus according to claim 23, wherein said [first] read control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [first] read control unit reads said data to be transmitted from said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said read address.

26. (Amended) The interleaving apparatus according to claim 24, wherein said [first] read control unit comprises a column number generating unit for randomly

generating column numbers and a row number generating unit for randomly generating row numbers, and said [first] read control unit reads said data to be transmitted from said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said read address.

27. (Unchanged) The interleaving apparatus according to claim 21, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

28. (Unchanged) The interleaving apparatus according to claim 22, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

29. (Unchanged) The interleaving apparatus according to claim 25, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

30. (Unchanged) The interleaving apparatus according to claim 26, wherein each of said column number generating unit and said row number generating unit is

configured with a memory for holding numbers used as addresses in a predetermined order.

31. **(Amended)** A de-interleaving apparatus for de-interleaving received data, comprising:

a [second] storing unit for storing said received data;

a [second] control unit for controlling said [second] storing unit so that said received data is outputted from said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

wherein said [second] control unit comprises a [second] write control unit for generating a write address to be used to write said received data in said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units at least between rows or between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to write said received data, and said [second] control unit reads said received data stored in said [second] storing unit according to the order of addresses of said [second] storing unit.

32. (Amended) A de-interleaving apparatus for de-interleaving received data,
comprising:

a [second] storing unit for storing said received data;

a [second] control unit for controlling said [second] storing unit so that said
received data is outputted from said [second] storing unit in a state before said received
data was interleaved by arranging said received data in a matrix and [randomly]
rearranging said received data by [exchanging data units between rows and between
columns] at least one of randomly interchanging rows of the matrix, each row
representing a set of data pieces of said data, and randomly interchanging columns of the
matrix, each column representing a set of data pieces of said data; and

wherein said [second] control unit comprises a [second] write control unit for
generating a write address to be used to write said data to be transmitted in said [second]
storing unit with said data to be transmitted arranged in a matrix and [randomly]
rearranged by [exchanging data units at least between rows or between columns]
randomly interchanging rows of the matrix, each row representing a set of data pieces of
said data, and by randomly interchanging columns of the matrix, each column
representing a set of data pieces of said data, and for writing said data to be transmitted in
said [second] storing unit so as to be read said data from said [second] storing unit
according to the order of addresses of said [second] storing unit.

33. (Amended) The interleaving apparatus according to claim 31, wherein said
[second] write control unit comprises a column number generating unit for randomly
generating column numbers and a row number generating unit for randomly generating

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row numbers, and said [second] write control unit writes said data to be transmitted in said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said write address to write said data to be transmitted in said [second] storing unit.

34. **(Amended)** The interleaving apparatus according to claim 32, wherein said [second] write control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [second] write control unit writes said data to be transmitted in said [first] storing unit with numbers generated by said column number generating unit and said row number generating unit as said write address to write said data to be transmitted in said [second] storing unit.

35. **(Amended)** A de-interleaving apparatus for de-interleaving received data, comprising:

a [second] storing unit for storing said received data;

a [second] control unit for controlling said [second] storing unit so that said received data is outputted from said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

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wherein said [second] control unit writes said data to be transmitted in said [second] storing unit according to the order of addresses of said [second] storing unit, and said [second] control unit comprises a [second] read control unit for generating a read address to be used to read said data to be transmitted from said [second] storing unit with said data to be transmitted stored in said [second] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.

36. (Amended) A de-interleaving apparatus for de-interleaving received data, comprising:

a [second] storing unit for storing said received data;

a [second] control unit for controlling said [second] storing unit so that said received data is outputted from said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data; and

wherein said [second] control unit comprises a [second] read control unit for generating a read address to be used to read said data to be transmitted, written in the order of addresses of said [second] storing unit, from said [second] storing unit with said

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data to be transmitted stored in said [second] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] <u>randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and by randomly interchanging columns of the matrix, each column representing a set of data pieces of said data,</u> to read said data to be transmitted.

37. (Amended) The de-interleaving apparatus according to claim 35, wherein said [second] read control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [second] read control unit reads said received data from said [second] storing unit with numbers generated by said column number generating unit and said row number generating unit as a read address.

38. (Amended) The de-interleaving apparatus according to claim 36, wherein said [second] read control unit comprises a column number generating unit for randomly generating column numbers and a row number generating unit for randomly generating row numbers, and said [second] read control unit reads said received data from said [second] storing unit with numbers generated by said column number generating unit and said row number generating unit as a read address.

39. (Unchanged) The de-interleaving apparatus according to claim 33, wherein each of said column number generating unit and said row number generating

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unit is configured with a memory for holding numbers used as addresses in a predetermined order.

40. (Unchanged) The de-interleaving apparatus according to claim 34, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

41. (Unchanged) The de-interleaving apparatus according to claim 37, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

42. (Unchanged) The de-interleaving apparatus according to claim 38, wherein each of said column number generating unit and said row number generating unit is configured with a memory for holding numbers used as addresses in a predetermined order.

43. (Amended) A transmitting apparatus with an interleaving function, comprising:

an error detection encoding unit for encoding an error detecting bit and for adding said error detecting bit to data to be transmitted;

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an error correction encoding unit for adding [the] an error correcting code, which is to be used for error correction, to said data to be transmitted, sent from said error detection encoding unit;

an interleaving unit which includes a [first] storing unit for storing said data to be transmitted, from said error detection encoding unit, and a [first] control unit for controlling said [first] storing unit so that said data to be transmitted is outputted from said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data;

a signal assembling unit assembles interleaved data from said interleaving unit to form a signal format suited for transmission; and

a spreading unit for converting the signal sent from said signal assembling unit into a spread signal using a predetermined spreading code.

44. (Amended) The transmitting apparatus with a interleaving function according to claim 43, wherein said [first] control unit comprises a [first] write control unit for generating a write address to be used to write said data to be transmitted in said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column

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representing a set of data pieces of said data, and for writing said data to be transmitted in said [first] storing unit, and said [first] control unit reads said data to be transmitted stored in said [first] storing unit according to the order of addresses of said [first] storing unit.

45. (Amended) The transmitting apparatus with a interleaving function according to claim 43, wherein said [first] control unit writes said data to be transmitted in said [first] storing unit according to the order of addresses of said [first] storing unit, and said [first] control unit comprises a [first] read control unit for generating a read address to be used to read said data to be transmitted from said [first] storing unit with said data to be transmitted stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.

46. (Amended) A receiving apparatus with a de-interleaving function, comprising:

a de-spreading unit for separating a desired signal from a received signal using a de-spreading code;

a data extracting unit for extracting received data from the signal separated by the de-spreading unit;

a de-interleaving unit which includes a [second] storing unit for storing said received data from said de-spreading unit, and a [second] control unit for controlling said

[second] storing unit so that said received data is outputted from said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] <u>at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data</u>;

an error correction decoding unit for decoding said received data de-interleaved by said de-interleaving unit, and for correcting an error included in said received data using an error correcting code; and

an error detecting unit for detecting an error detecting bit added when said received data is transmitted on the basis of a bit structure of the error detecting bit previously set.

47. (Amended) The receiving apparatus with a de-interleaving function according to claim 46, wherein said [second] control unit comprises a [second] write control unit for generating a write address to be used to write said received data in said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units at least between rows or between columns] <u>at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data</u>, to write said received data, and said [second] control unit reads

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said received data stored in said [second] storing unit according to the order of addresses of said [second] storing unit.

48. (Amended) The receiving apparatus with a de-interleaving function according to claim 46, wherein said [second] control unit writes said data to be transmitted in said [second] storing unit according to the order of addresses of said [second] storing unit, and said [second] control unit comprises a [second] read control unit for generating a read address to be used to read said data to be transmitted from said [second] storing unit with said data to be transmitted stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.

49. (Amended) A transmitting and receiving apparatus with a interleaving and de-interleaving function, comprising:

an error detection encoding unit for encoding an error detecting bit and for adding said error detecting bit to data to be transmitted;

an error correction encoding unit for adding [the] an error correcting code, which is to be used for error correction, to said data to be transmitted, sent from said error detection encoding unit;

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an interleaving unit which includes a [first] storing unit for storing said data to be transmitted, from said error detection encoding unit, and a [first] control unit for controlling said [first] storing unit so that said data to be transmitted is outputted from said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data;

a signal assembling unit assembles interleaved data from said interleaving unit to form a signal format suited for transmission;

a spreading unit for converting the signal sent from said signal assembling unit into a spread signal using a predetermined spreading code;

a duplexer for transmitting the spread signal from said spreading unit to an antenna;

a de-spreading unit for separating a desired signal from a received signal via said antenna and duplexer using a de-spreading code;

a data extracting unit for extracting received data from the signal separated by the de-spreading unit;

a de-interleaving unit which includes a [second] storing unit for storing said received data from said de-spreading unit, and a [second] control unit for controlling said [second] storing unit so that said received data is outputted from said [second] storing unit in a state before said received data was interleaved by arranging said received data in a matrix and [randomly] rearranging said received data by [exchanging data units between rows and between columns] at least one of randomly interchanging rows of the

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matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data;

an error correction decoding unit for decoding said received data de-interleaved by said de-interleaving unit, and for correcting an error included in said received data using an error correcting code; and

an error detecting unit for detecting an error detecting bit added when said received data is transmitted on the basis of a bit structure of the error detecting bit previously set.

50. (Amended) The transmitting and receiving apparatus according to claim 49, wherein said [first] control unit comprises a [first] write control unit for generating a write address to be used to write said data to be transmitted in said [first] storing unit with said data to be transmitted arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, and for writing said data to be transmitted in said [first] storing unit, and said [first] control unit reads said data to be transmitted stored in said [first] storing unit according to the order of addresses of said [first] storing unit.

51. (Amended) The transmitting and receiving apparatus according to claim 49, wherein said [first] control unit writes said data to be transmitted in said [first] storing

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unit according to the order of addresses of said [first] storing unit, and said [first] control

unit comprises a [first] read control unit for generating a read address to be used to read

said data to be transmitted from said [first] storing unit with said data to be transmitted

stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by

[exchanging data units at least between rows or between columns] at least one of

randomly interchanging rows of the matrix, each row representing a set of data pieces of

said data, and randomly interchanging columns of the matrix, each column representing a

set of data pieces of said data, to read said data to be transmitted.

52. (Amended) The transmitting and receiving apparatus according to claim 49,

wherein said [second] control unit comprises a [second] write control unit for generating

a write address to be used to write said received data in said [second] storing unit in a

state before said received data was interleaved by arranging said received data in a matrix

and [randomly] rearranging said received data by [exchanging data units at least between

rows or between columns] at least one of randomly interchanging rows of the matrix,

each row representing a set of data pieces of said data, and randomly interchanging

columns of the matrix, each column representing a set of data pieces of said data, to write

said received data, and said [second] control unit reads said received data stored in said

[second] storing unit according to the order of addresses of said [second] storing unit.

53. (Amended) The transmitting and receiving apparatus according to claim 49,

wherein said [second] control unit writes said data to be transmitted in said [second]

storing unit according to the order of addresses of said [second] storing unit, and said

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[second] control unit comprises a [second] read control unit for generating a read address to be used to read said data to be transmitted from said [second] storing unit with said data to be transmitted stored in said [first] storing unit arranged in a matrix and [randomly] rearranged by [exchanging data units at least between rows or between columns] at least one of randomly interchanging rows of the matrix, each row representing a set of data pieces of said data, and randomly interchanging columns of the matrix, each column representing a set of data pieces of said data, to read said data to be transmitted.